A New Camallanid Nematode from Hawaii

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ABSTRACT: *Spirocamallanus istiblenni* n. sp. is described from the intestine of *Istiblennius zebra,* a tidepool fish at Oahu, Hawaii. Female worms average 21.5 mm long, and the adult female:male length ratio is 1.44:1.0. The chief diagnostic characters include a reduced posterior ovary, a male caudal papillae pattern of six preanal and three postanal, a spicule length ratio of 3:2, and an H-shaped arrangement of the anterior excretory canal system. The buccal capsule possesses 13–14 spiral thickenings. The possible evolutionary significance of the posterior ovary is mentioned; a list of other parasites of this host and ecological considerations are included.

DURING THE MONTHS from November 1962 to April 1963 I collected tidepool fishes at several points around the island of Oahu, Hawaii and examined them for protozoan, helminth, and arthropod parasites. Among the fishes were 50 specimens of *Istiblennius zebra,* half of which contained, in their intestines, nematodes belonging to the genus *Spirocamallanus.* A detailed study of this worm shows it to be a new species, and requires a modification of presently accepted diagnostic characteristics of the genus and of the family Camallanidae.

THE HOST AND ITS ENVIRONMENT

Istiblennius zebra, family Blenniidae, lives as an adult among rocks along the shore and is often abundant in small tidepools. Temperature changes in the water of these pools varied (during the days that I was there) between 22.6 C to 34.8 C, and salinity changes varied between 33.68‰ to 36.20‰. Eggs of the fish are deposited in the pools, and larvae migrate to open water off shore. Young fish return to the rocky shores where they spend the remainder of their lives. Adult fish feed primarily on a precipitated organic detritus called "leptopel" which appears to be chiefly of algal origin. Snails, green algae, and ostracods were occasionally found in the stomach. Other organisms in the pools were plankton (copepods, ostracods, crustacean larvae, juvenile snails, nematodes, unicellular algae, filamentous algae, diatoms), fish (*Bathygobius fuscus, Abudefduf sordidus,* other small fish), sea urchins, sea anemones, shrimps, colonial ascidians, small nudibranchs in clumps of algae, annelids, snails (*Littorina picta, L. pintado, Nerita neglecta, Morula nudus, Cerithium* sp., and others), and algae (*Lyngbya majuscula, Valonia aegagropila,* and other species). When the host fish were found on coral reefs they were associated with the multitudinous fishes and other organisms common to the reefs.

THE PARASITE

Spirocamallanus istiblenni n. sp.
(Figs. 1–10)

HOST: *Istiblennius zebra* (Vailland & Sauvage).

SITE OF INFECTION: Intestine (of 25 out of 50 hosts).

LOCATION: Marine tidepools at Oahu, Hawaii.

SYNTYPES: U. S. Nat. Hist. Mus. Helm. Coll. Nos. 32914 (male), 32915 (female).

DESCRIPTION: A tabulation of measurements, based on nine females and five males, is given in Table 1.

The chief features that distinguish *Spirocamallanus istiblenni* from other described species are the presence of a posterior ovary, the caudal

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TABLE 1

MEASUREMENTS OF *Spirocamallanus istiblenni*

	MALE (MM)	FEMALE (MM)
Body length	14.900	21.500
Body width	0.221	0.326
Anus to posterior end	0.166	0.177
Excretory pore to anterior end	0.400	0.400
Vulva to anterior end	—	8.200
Buccal capsule, length	0.075	0.077
Buccal capsule, width	0.072	0.077
Esophagus (muscular) length	0.325	0.397
Esophagus (glandular) length	0.485	0.588
Nerve ring to anterior end	0.208	0.220
Right spicule, length	0.274	—
Left spicule, length	0.184	—
Number preanal papillae	6	—
Number postanal papillae	3	—
Anterior ovary length	—	6.100 (max. 10.0)
Posterior ovary length	—	0.850 (max. 01.0)
Mature ova in anterior ovary	—	0.011 × 0.015
Ova in posterior ovary	—	0.008 × 0.010

papillae pattern (six preanal, three postanal) in the male, the spicule length ratio of 3:2, the female:male body length ratio of 1.44:1, and the arrangement of the anterior excretory canals. These features, and others, will be discussed briefly.

The mouth is circular, without lips. An *en face* view of a preserved specimen shows that the anterior surface of the buccal capsule possesses eight lateral projections, and is surrounded by inconspicuous folds (Fig. 1). The orange-brown buccal capsule (Fig. 2) is lined with 13 or 14 spiral thickenings. Between the buccal capsule and the body wall are located four elongated buccal sinuses, two dorsal and two ventral in position. These sinuses are probably

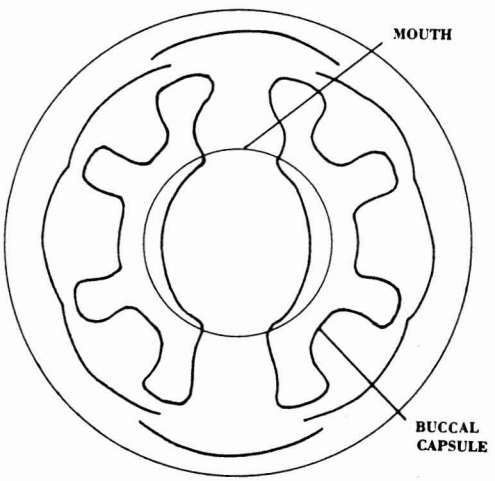

FIG. 1. *En face* view. The outer surface around the mouth is smooth.

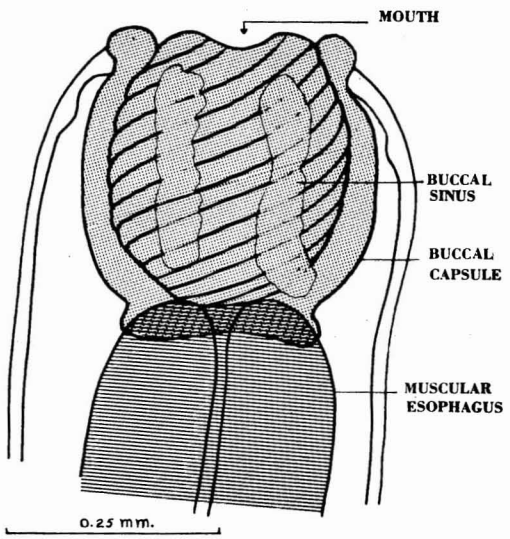

FIG. 2. Lateral view of head to show the buccal capsule and position of buccal sinuses.

a part of the osmoregulatory system, but connections between them and the excretory canals were not clearly distinguished.

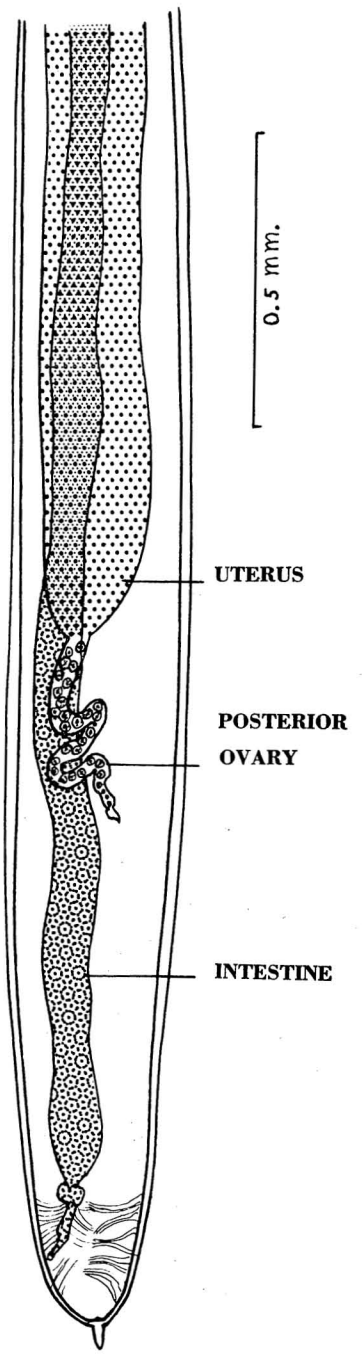

FIG. 3. Posterior end of a female worm, showing the posterior vestigial ovary.

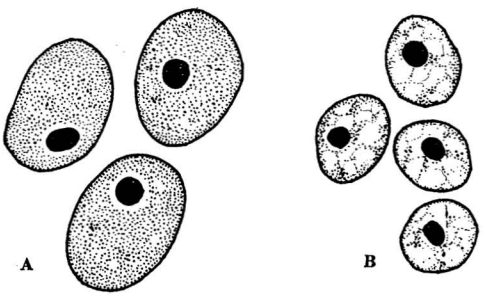

FIG. 4. *A,* Ova from an anterior ovary; *B,* ova from a posterior ovary. Immature ova in an anterior ovary appear similar to those in *B.*

One of the important diagnostic characteristics of the family Camallanidae, as listed in the literature, has been a blind posterior branch of the uterus. The posterior ovary in *Spirocamallanus istiblenni* (Fig. 3) is normally much shorter than the anterior ovary, and it contains cells that appear similar to the immature ova in the first portion of the anterior ovary (Fig. 4). The posterior ovary is probably vestigial, and thus appears to represent a last stage in the evolutionary progression toward the elimination of one ovary. The large, coiled, anterior ovary, plus the oviduct, reaches a maximum length of about 10 mm, or half of the total body length. The oviduct narrows before it enters the expanded seminal receptacle (Fig. 5), which itself narrows before entering the large, thin-walled uterus. At this latter junction the walls contain glandular cells. In one of the nine female worms the long, functioning ovary is not anterior in position, but is posterior, and the seminal receptacle expands to form the posterior horn of the uterus.

The male caudal papillae are grouped as shown in Figure 6, and the alae curve anteriorly to meet ventrally. The two spicules bear a length ratio of 3:2 (Figs. 6, 7). In both male and female worms the lower part of the intestine and the rectal gland are supported by conspicuous muscle fibers (Figs. 6, 8). In the male the anus is surrounded by four small papillae (adanal), a condition not uncommon in this genus. The posterior finger-like tip of the body has from zero to three minute projections.

Two excretory canals run the entire length of the worm, and join at about the level of the glandular esophagus to form an excretory sinus

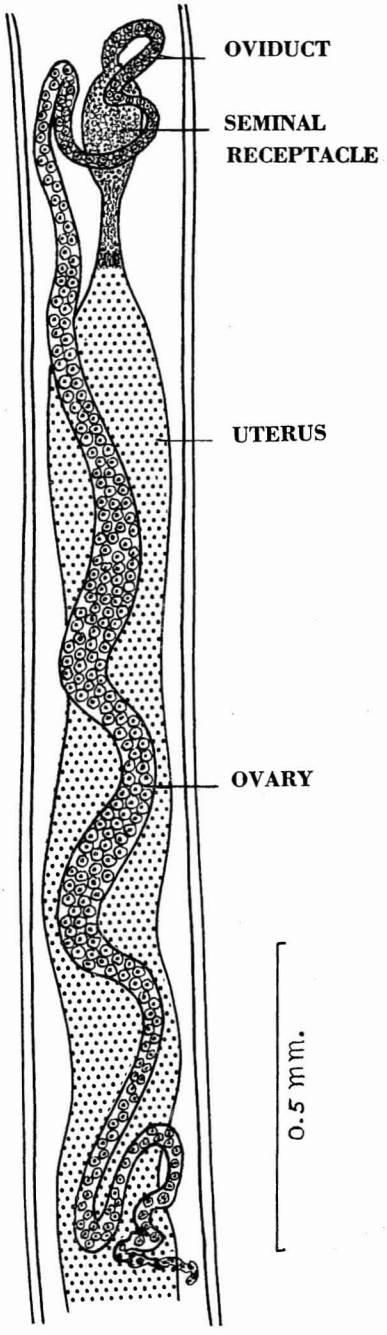

FIG. 5. The anterior ovary, oviduct, and seminal receptacle.

(with a large sinus nucleus) that opens to the exterior by a short excretory duct (Fig. 9). The vulva is located just anterior to the middle of the female body, and the vagina extends posteriorly, for about 1.3 mm, to the uterus (Fig. 10). The distal portion of the vagina has a thick, muscular wall and is about 0.4 mm long.

DISCUSSION

A number of copepods collected in the tidepools with *Istiblennius zebra* were examined for larval stages of the parasite, but no larvae were

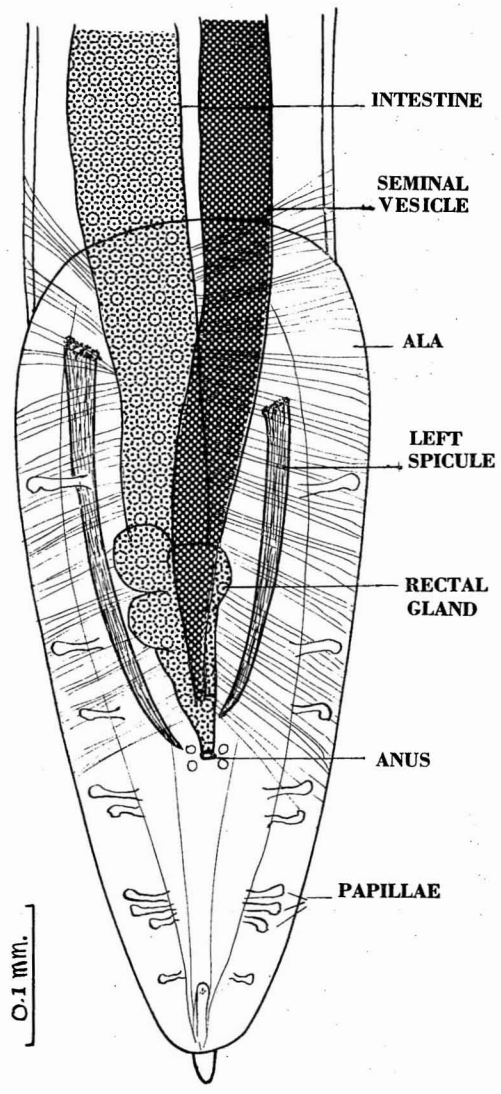

FIG. 6. Posterior end of a male worm, ventral view. Note particularly the number and arrangement of papillae and relative sizes of the spicules.

found. The average number of worms in infected hosts was 5, the maximum was 30. The population of parasites, therefore, was sufficiently dense to provide numerous larvae in the water. All of the mature female worms were filled with larvae in all stages of development, including actively moving forms ready to leave the mother. The absence of parasites in the copepods is difficult to explain, since copepods are presumably the intermediate hosts. The season of the year might be a factor, but probably not enough copepods were examined.

There is no evidence that the worms are pathogenic to the host. Any consideration of parasite-host relationships should include at least a notice of the total parasite fauna. Other parasites found in the 50 hosts examined were:

On the gills: *Trichodina* (closely similar to *Paratrichodina obliqua*), *Gyrodactylus* sp., metacercariae, and a microcotyline monogenetic trematode.

In the gall bladder: the myxosporidians, *Zschokkella* and *Ceratomyxa.*

In the muscles: metacercarial cysts.

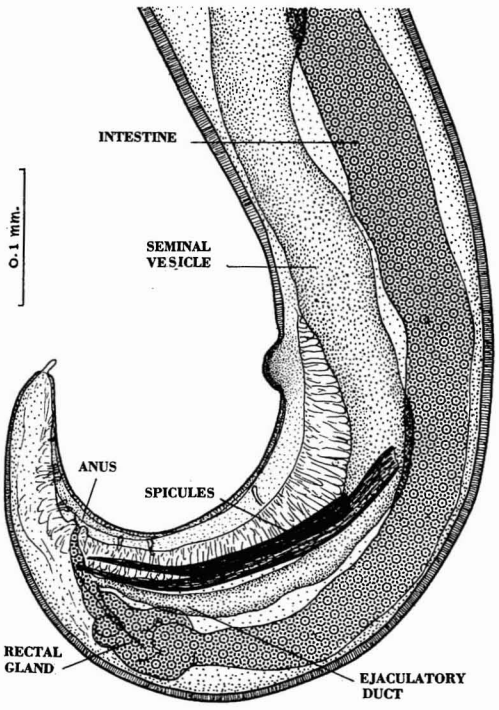

FIG. 7. Posterior end of a male worm, lateral view.

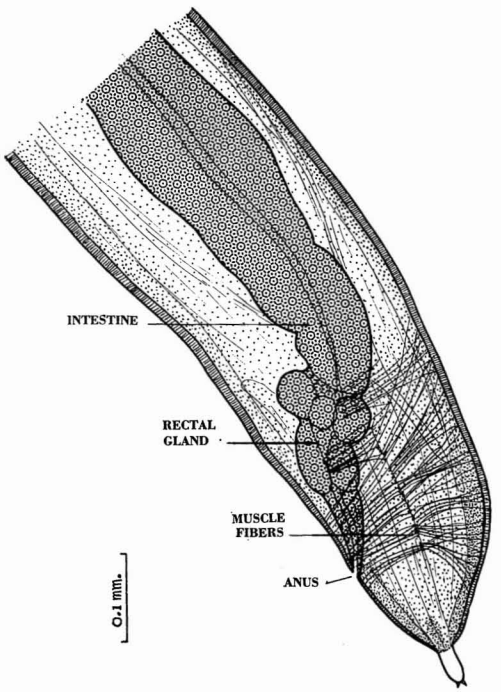

FIG. 8. Posterior end of a female worm, lateral view.

In the digestive tract: metacercarial cysts (in only one host).

The paucity of parasites in the intestine is probably correlated with the host's habit of feeding primarily on an organic detritus. *Spirocamallanus istiblenni* obviously does not have much competition for space and nutrients except that provided by its host.

In 1952 Olsen erected a new genus, *Spirocamallanus,* to accommodate 17 species of *Procamallanus* characterized by spiral thickenings inside the buccal capsule. Ali (1960) has pointed out that within the genus *Procamallanus* there are species with "comb-like chitinous plates," finger-like projections, "golf club shaped projections," "knob-like structures," transverse thickenings, and other modifications of the buccal capsule wall. Ali believes that the use of spiral thickenings as the sole basis of distinction is not warranted, and that the spicule pattern in the male offers morphological variations that are more sharply defined. Some worms do not possess spicules, in others there are one or two, and in the latter group the

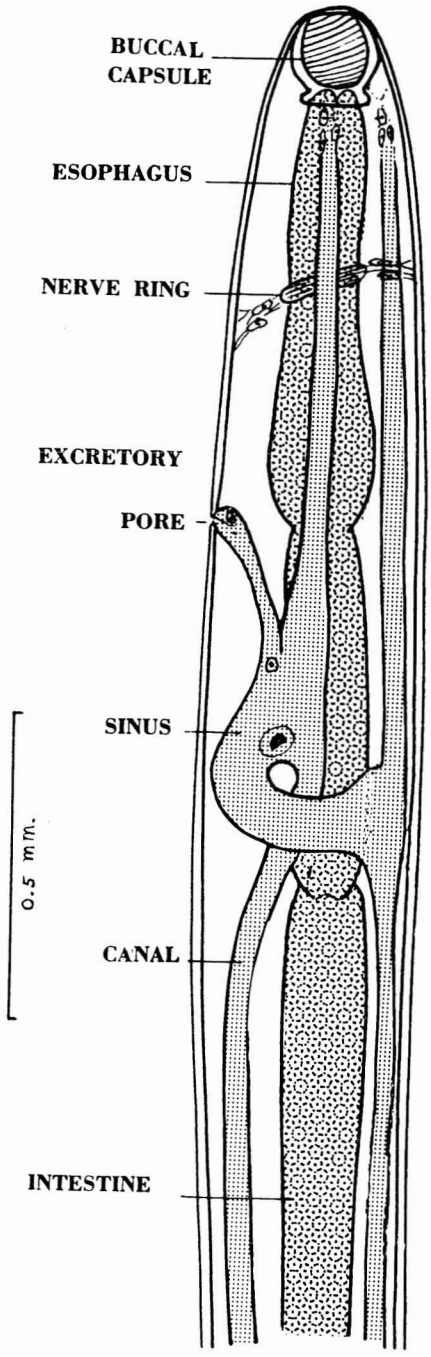

FIG. 9. Dorsal view of anterior end to show excretory canals, sinus, and excretory pore.

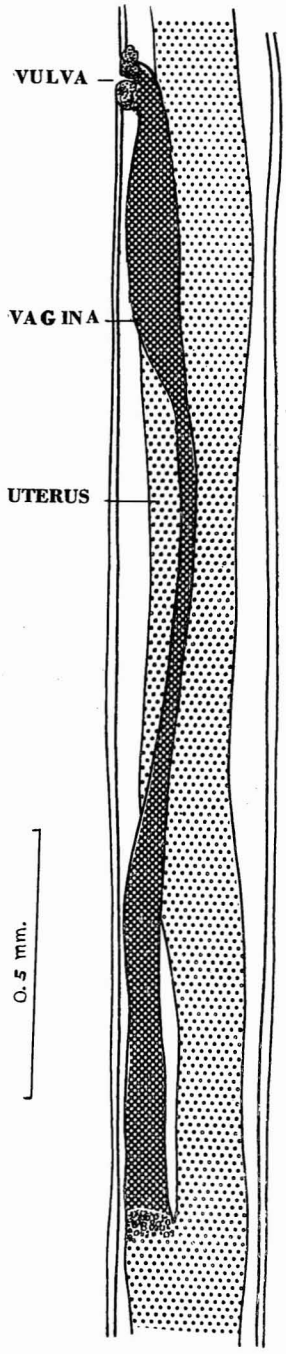

FIG. 10. An area just anterior to middle of female body, to show the vulva, vagina, and connection with uterus.

TABLE 2

COMPARISON OF *S. istiblenni* WITH TWO OTHER SPECIES OF *Spirocamallanus*

FEATURE	*S. istiblenni*	*S. spiralis*	*S. pereirai*
Posterior ovary	present	absent	absent
Female:male body length ratio	1.44:1	1:3	1.4:1
Caudal papillae (male)	9 pair	7–9 or more	9 pair
No. buccal capsule spirals	13–14	12	14
Right spicule, length	0.27 mm	0.15 mm	0.21 mm
Left spicule, length	0.18 mm	0.1 ± mm	0.21
Length ratio of spicules	3:2	1.5:1	2:1

spicules are equal or unequal in length. Using these characteristics, Ali has created four subgenera: *Aspiculus, Monospiculus, Isospiculus,* and *Procamallanus.* One objection to using this basis of classification is that a male worm must be found before the female can be specifically identified. Also, Olsen (1952) has raised some doubt as to the existence of males with only one spicule. Yeh (1960) has dealt with the problem of varieties of buccal capsule linings by using them as bases for a "reconstruction of the genus *Camallanus.*" He created two new subfamilies: Camallaninae and Procamallaninae. The latter consists of two genera: *Procamallanus* (Baylis, 1923) with a smooth buccal capsule lining, and *Spirocamallanus* Olsen, 1952, with spiral thickenings. I am inclined to agree with Yeh.

Spirocamallanus istiblenni appears to be most similar to *S. pereirai* (Annereaux, 1946) and *S. spiralis* (Baylis, 1923). Some comparative features are listed in Table 2.

In the light of the descriptions presented in this paper the diagnostic characteristics of the family Camallanidae and of the genus *Spirocamallanus* should include the statement that the posterior horn of the uterus is usually blind, but that a second, posterior, reduced ovary may be present.

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